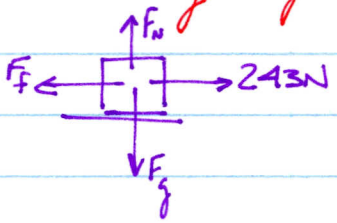
Newton's 2nd Law + Kinematic Eq^ns

#1 Assuming uniform motion



(b) Under uniform motion conditions, $\vec{F}_{NET} = 0$. Thus forces are balanced and $F_f = 243N$ in opposite direction

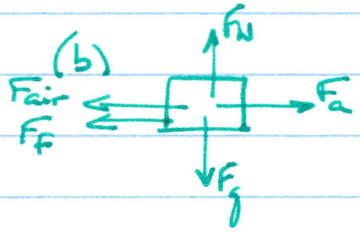
#4 $m = 1200\ kg$

$\vec{v}_1 = 50 km/h = 13.89 m/s$

$F_f = -7500N$

$F_{air} = -5000N$

$F_a = 17500N$



$\vec{F}_{NET} = m\vec{a}$

$17500 - 7500 - 5000 = 1200a$

$5000 = 1200a$

$a = 4.17 m/s^2$

(c) $\vec{v}_1 = 13.89 m/s$

$\vec{v}_2 = ?$

$\vec{a} = 4.17 m/s^2$

$\Delta\vec{d} = 1000 m$

$\vec{v}_2^2 = \vec{v}_1^2 + 2\vec{a}\Delta\vec{d}$

$= 13.89^2 + 2(4.17)(1000)$

$\vec{v}_2 = 92.4 m/s$

$= 332 km/h$

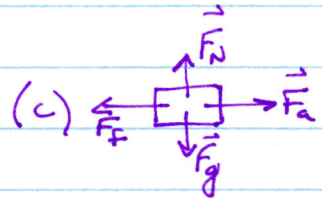
#5 $m = 1100 kg$

$\vec{a} = 3.40 m/s^2$

(a) $\vec{F}_{NET} = m\vec{a}$

$= 1100(3.4)$

$= 3740N$



$\vec{F}_{NET} = 3740N$

$\vec{F}_a + \vec{F}_f = 3740$

$5600 + \vec{F}_f = 3740$

$\vec{F}_f = -1860N$

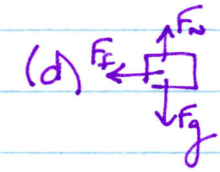
(b) $\vec{v}_1 = 0 m/s$

$\vec{v}_2 = ?$

$\vec{a} = 3.40 m/s^2$

$\Delta t = 30s$

$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t = 102 m/s$



$\vec{F}_{NET} = m\vec{a}$

$-1860 = 1100a$

$a = -1.69 m/s^2$

$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t$

$0 = 102 + (-1.69)\Delta t$

$\Delta t = 60.3s$

#6 $\vec{F}_{NET} = 20000\,N$, $m = 2000\,kg$

$\vec{F}_{NET} = m\vec{a}$

$20000 = 2000\,a$

$a = 10\,m/s^2$

$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t$

$\Delta\vec{v} = 10(6)$

$= 60\,m/s$

#7 $m = 4000\,kg$

$F_{NET} = ?$

need $\vec{a}$

$\vec{v}_1 = 22\,m/s$

$\vec{v}_2 = 8\,m/s$

$\Delta t = 3.50\,s$

$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t$

$8 = 22 + \vec{a}(3.5)$

$\vec{a} = -4.00\,m/s^2$

$\therefore F_{NET} = ma$

$= -4(4000)$

$= -16000\,N$

#8 $m = 60\,kg$, $\vec{F}_{NET} = 48\,N$

$\vec{F}_{NET} = m\vec{a}$

$48 = 60\,\vec{a}$

$\vec{a} = 0.80\,m/s^2$

$\vec{v}_1 = 0\,m/s$

$\vec{v}_2 = 4.0\,m/s$

$\Delta t = ?$

$\vec{a} = 0.80\,m/s^2$

$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t$

$4 = 0.8\,\Delta t$

$\Delta t = 5.0\,s$

#9 $m = 5.0\,kg$

$\vec{v}_1 = 0\,m/s$

$\vec{v}_2 = 150\,m/s$

$\Delta t = 0.05\,s$

$\vec{a} = ?$

$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t$

$150 = \vec{a}(0.05)$

$\vec{a} = 3000\,m/s^2$

$\vec{F}_{NET} = m\vec{a}$

$= 5(3000)$

$= 15000\,N$

#10 $m = 500\,g = 0.50\,kg$

$\vec{v}_1 = 20\,m/s$

(a) $\vec{v}_2 = 45\,m/s$

$\Delta t = 0.70\,s$

$\vec{v}_2 = \vec{v}_1 + \vec{a}\Delta t$

$45 = 20 + \vec{a}(0.70)$

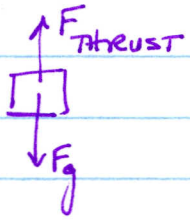
$\vec{a} = 35.7\,m/s^2$

$\vec{F}_{NET} = m\vec{a}$

$= 0.50(35.7)$

$= 17.86\,N$

(b)



$\vec{F}_{NET} = \vec{F}_{THRUST} + \vec{F}_g$

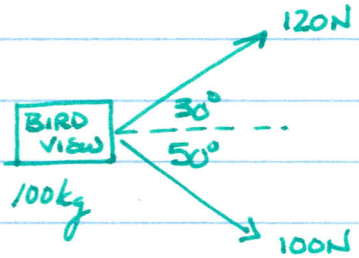
$17.86 = \vec{F}_{TH.} + mg$

$\vec{F}_{TH} = 17.86 + mg$

$= 17.86 + (0.5)(9.8)$

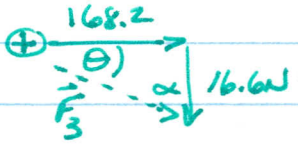
$= 22.76\,N$

#11



VECTOR COMPONENTS! HOW? NON-COLINEAR VECTORS.

HORIZ.	VERT.
$\vec{F}_{1x} = 120\cos 30\ N$	$\vec{F}_{1y} = 120\sin 30\ N$
$\vec{F}_{2x} = 100\cos 50°\ N$	$\vec{F}_{2y} = -100\sin 50\ N$
$\vec{F}_{3x} = 168.2\,N$	$\vec{F}_{3y} = -16.6\,N$



$\left|\vec{F}_3\right| = \sqrt{168.2^2 + 16.6^2}$

$= 169\,N$

$\alpha = \tan^{-1}\left(\frac{168.2}{16.6}\right)$

$= 84.4°$ so $\theta =$

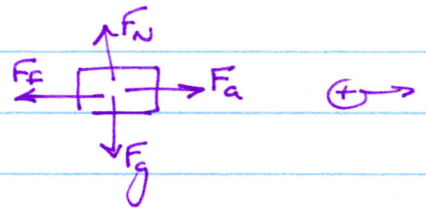
$\vec{F}_{NET} = m\vec{a}$

$169 = 100\,\vec{a}$

$\vec{a} = 1.69\,m/s^2\,[E\,5.6°S]$

$\therefore \vec{F}_{NET} = \vec{F}_3 = 169\,N\,[E\,5.6°S]$

#12



(a) $\vec{V}_1 = 2.0\,m/s\ [R]$

$\Delta t = 8.50s$

$m = 80\,kg$

$\Rightarrow \quad \vec{F}_{NET} = \vec{F}_a + \vec{F}_f$

$= 100 - 20$

$= 80\,N\ [R]$

$\Rightarrow \quad F_{NET} = m\vec{a}$

$80 = 80\vec{a}$

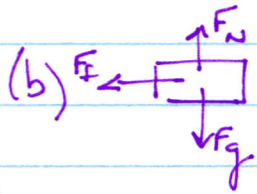
$\vec{a} = 1.0\,m/s^2$

$\vec{V}_2 = \vec{V}_1 + \vec{a}\Delta t$

$= 2.0 + (1)(8.5)$

$= 10.5\,m/s.$

(b)



$\vec{V}_1 = 10.5\,m/s$

$\vec{V}_2 = 0\,m/s$ (object is decel.)

$\Delta\vec{d} = ?$

$\vec{a} = ?$

$\Rightarrow \quad \vec{F}_{NET} = \vec{F}_f$

$= -20\,N$

$\Rightarrow \quad \vec{F}_{NET} = m\vec{a}$

$-20 = 80\,a$

$\vec{a} = -0.25\,m/s^2$

$\vec{V}_2^{\,2} = \vec{V}_1^{\,2} + 2\vec{a}\Delta\vec{d}$

$0 = 10.5^2 + 2(-0.25)\Delta\vec{d}$

$\Delta\vec{d} = 220.5\,m$